

U.G. 6th Semester Examination-2021**Molecular Biology****[PROGRAMME]****Discipline Specific Elective (DSE)****Course Code : MBG-DSE-4-T-601&602**

Full Marks : 40

Time : $2\frac{1}{2}$ Hours*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.***Answer all the questions from selected Option.****OPTION-A****MBG-DSE-4-T-601****(Inheritance Biology)**1. Answer any **five** of the following: $2 \times 5 = 10$

- State Mendel's principle of independent assortment. Which chromosomal event is associated with this phenomenon?
- Why X-linked recessive diseases manifest more frequently in males as compared to females?
- Who coined the term epistasis? What is epistasis?
- Depict a test cross by a punnett square.

- Draw a pedigree showing maternal inheritance pattern.
- Imagine an individual with the genotype AaDdgg, where each of these genes is on a different chromosome. How many different gametes types can be formed by this individual? What are the gametes?
- Distinguish incomplete dominance from and codominance.
- Write a short note on F plasmid.

2. Answer any **two** questions: $5 \times 2 = 10$

- Distinguish between physical map and genetic map. The genes C, M, P, S are linked. Crossover map distances determined by 2-point cross over are P - C = 7, S - M = 10, C - M = 8, S - C = 2 and P - S = 5. Determine the relative order of these 4 loci. $2+3$
- Pictorially represent the Parental ditype (PD), Nonparental ditype (NPD) and, Tetratype (T) ascus considering a cross between unlinked yeast mutations. Comment on the frequency of PD and NPD in this case. $4+1$
- In pea, yellow colour (Y) and round texture (R) is dominant over green colour (y) and wrinkled texture (r). When YyRr plants were self-

fertilized, a total of 586 progeny pea plants were obtained, showing a phenotypic ratio of 9:3:3:1. How many phenotypic classes do you expect from the experiment? Calculate the approximate number of plants in each phenotypic class.

2+3

- d) Determine the sexual phenotype of *Drosophila* with chromosome composition 3X:4A. How many Barr bodies may be found in the nuclei of human cells with chromosome composition XYY?

$2\frac{1}{2} + 2\frac{1}{2}$

3. Answer any **two** questions: 10×2=20

- a) Explain along with diagram how the *E. coli* chromosome with a length of about 1500 μm is accommodated within its cell with diameter of around 1-2 μm. 10
- b) Name the various modes of horizontal gene transfer in bacteria. Describe any one of them. 3+7
- c) What are maternal effect genes? Describe how such genes regulate dorsoventral patterning in *Drosophila*. 2+8
- d) Illustrate how ABO blood group in human can be set as an example for both multiple allelism and codominance. 5+5

OPTION-B
MBG-DSE-4-T-602
(Immunology)

1. Answer any **five** of the following: 2×5=10

- a) What are the basic differences between active and passive immunity?
- b) What is T_H cell? How it differs from T_C cell?
- c) Only IgG can cross the placental barrier. Explain.
- d) What is superantigen?
- e) Define antigenic determinants.
- f) What is autoimmunity?
- g) What are the functions of macrophages?
- h) What are interferons?

2. Answer any **two** questions: 5×2=10

- a) Describe the properties and functions of cytokines. Give examples of therapeutic cytokines. 4+1
- b) Describe how C3 convertase is formed by classical pathway of complement system. Why IgM is more efficient to activate classical complement system compared to IgG? 5
- c) What is the difference between antigen and immunogen? Write about the factors influencing immunogenicity of the pathogen.

2+3

d) What is MHC? Describe the major features of MHC Class I antigens. 2+3

3. Answer any **two** questions: 10×2=20

a) Write short notes on (any **two**): 5+5

i) Thymus

ii) APC

iii) Humoral immune responses

b) What is the name of the hypervariable region of immunoglobulin responsible for its diversity? An energetic immunology student has isolated a protein 'X' which he believes to be a new isotype of human immunoglobulin. What structural features would protein 'X' have in order to be classified as an immunoglobulin? Discuss. What is opsonisation? 1+6+3

c) What is anaphylaxis? Describe the causes, mechanism, and symptoms of anaphylaxis. 2+8

d) Define vaccine. How is DNA vaccine formed? Write about the advantages and disadvantages of using attenuated organisms as vaccines. 1+6+3
